Final Draft Report

Downtown Louisville Two-Way Street Study

Submitted to

Downtown Development Corporation

Submitted by

ENTRAN, PLC

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Introduction

The Downtown Development Corporation (DDC) initiated this study to evaluate the feasibility of converting one-way streets in downtown Louisville to two-way operation. The study serves as an update to the 2002 study conducted by ENTRAN (as American Consulting Engineers, PLC) that evaluated the conversion of several one-way streets to two-way traffic flow. That study limited its focus on the streets within the Central Business District (CBD), where this study examines nearly all of the downtown street system.

It has been argued that converting two-way streets to one-way traffic flow decades ago was an effort to move traffic out of downtowns; some one-way street opponents claim that this traffic never returned, resulting in the decline of quality of life within downtowns. One-way streets make for efficient movers of traffic, but can often introduce safety concerns for motorists, bicyclists and pedestrians because they tend to provide for higher travel speeds than two-way streets. The counter-argument is that two-way streets introduce more conflict points for bicyclists and pedestrians as they are forced to contend with traffic coming from more than one direction.

The benefits of two-way streets are numerous. They tend to have slower travel speeds than one-way streets, they reduce confusion for motorists unfamiliar with the area, they provide better access to both businesses and residential areas, and in some circumstances they can reduce the traffic load on other one-way streets. Two-way streets also have numerous disadvantages. These disadvantages include a potential loss of vehicular capacity and on-street parking. The loss of on-street parking may result from the need to provide turning lanes at intersections or even the need to provide an additional travel lane. Finally, two-way streets increase the number of conflict points with which pedestrians must contend. Rather than crossing the street at locations where traffic is coming from a single direction, pedestrians are faced with traffic from two directions.

Traffic impacts are just one of many factors that must be taken into consideration when it comes to determining feasibility for converting one-way streets to two-way traffic. Downtown streets serve as more than just traffic movers - they provide access to businesses, residential areas, and local attractions. One-way streets in some cases hinder opportunities for economic development as certain businesses have a formal policy against locating on one-way streets. Thus, city leaders must look at the big picture when faced with this decision.

Study Purpose

The purpose of this study is to determine the potential traffic impacts associated with converting one-way streets in the downtown system to two-way traffic. This evaluation includes estimating the likely operational characteristics of various scenarios where all or portions of some streets are converted to two-way flow. The study area is shown in **Figure 1**. The limits are Ninth Street to the west, Oak Street to the south, Baxter Avenue to the east and the Ohio River to the north.

This study focuses primarily on exploring likely two-traffic scenarios and evaluating the traffic performance of each scenario. Other issues, such as impacts to parking garage access and implications associated with future development downtown are also discussed.

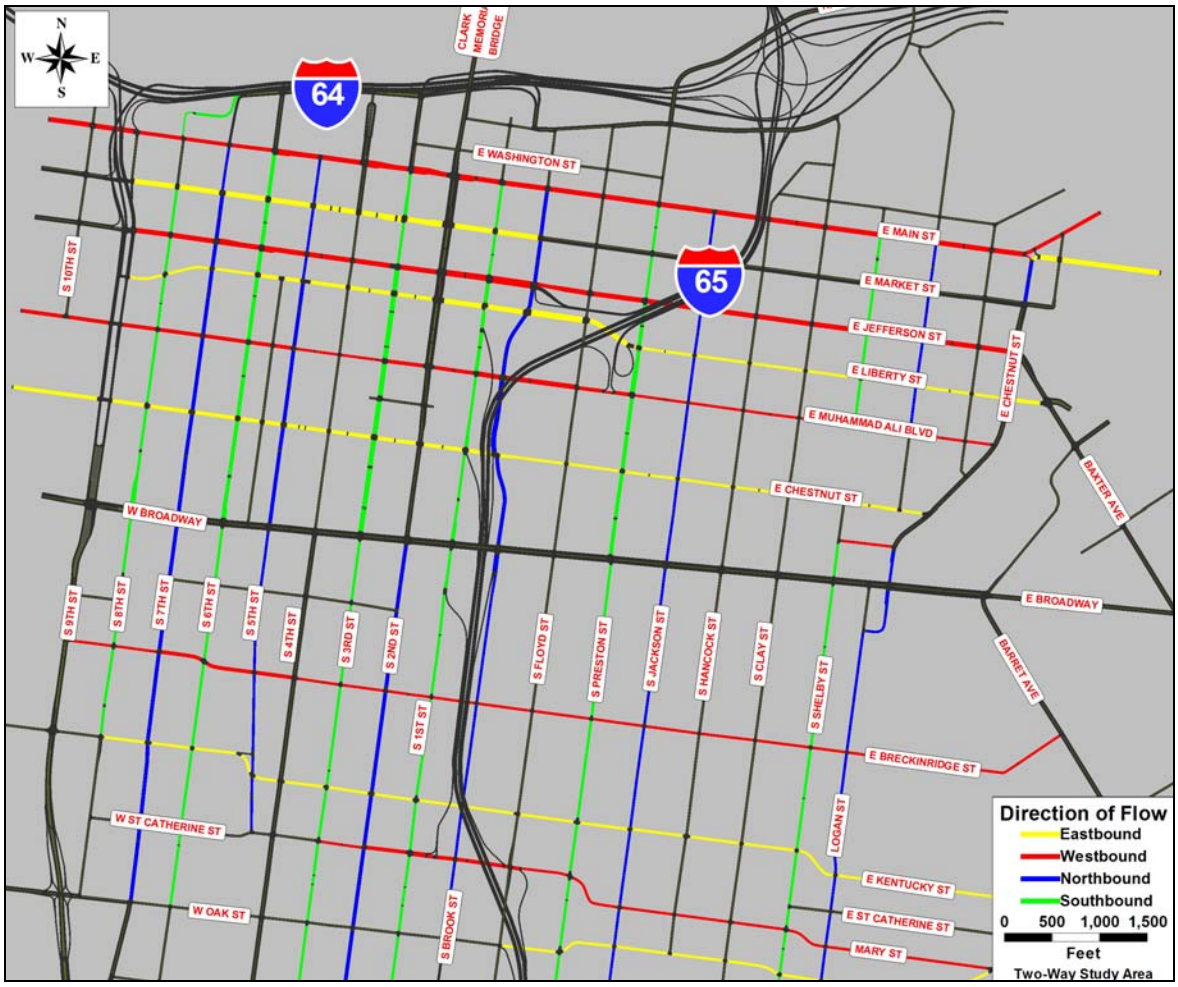

Figure 1: Study Area

Methodology

The Downtown Louisville Two-Way Street Study involved a number of tasks. This chapter briefly summarizes the activities undertaken over the course of the study.

Data Collection

Much of the data necessary to conduct the study were readily available or could be collected through site visits. Most needed geometric data for the existing street system were collected during previous studies performed by ENTRAN. The study area includes approximately 78 roadway-miles and 220 traffic signals. **Table 1** summarizes the existing one-way streets within the study area.

Over the past several years, portions of some streets within the study area have been converted from one-way to two-way traffic. The most significant of these changes was 2nd Street, which was reconstructed and converted to two-way traffic between Broadway and Market Street (2nd Street was previously two-way only between Main and Market Street). Portions of other roadways south of Broadway were converted to two-way traffic in 2002, including St. Catherine Street west of 3rd Street and Oak Street west of Floyd Street.

At the onset of the study, Louisville Metro Public Works was in the process of updating traffic signal timings for the entire downtown traffic signal system. These data were supplied to ENTRAN as available. In addition, recent traffic count data were provided to supplement turning movement counts previously supplied to ENTRAN.

Table 1. Existing One-Way Streets

Direction	Street Name	Segment
Eastbound	Market Street	Ninth St. to Brook St.
	Liberty Street	Ninth St. to Baxter Ave.
	Chestnut Street	Ninth St. to Campbell St.
	Kentucky Street	Eighth St. to Barret Ave.
	St. Catherine Street	Third St. to Oak St.
Westbound	Main Street	Baxter Ave. to Ninth St.
	Jefferson Street	Baxter Ave. to Ninth St.
	Muhammad Ali Blvd.	Campbell St. to Ninth St.
	Breckinridge Street	Barret Ave. to Ninth St.
	Oak Street	Floyd St. to Mary St.
Northbound	Seventh Street	Oak St. to Main St.
	Fifth Street	St. Catherine St. to Main St.
	Second Street	Oak St. to Broadway
	Brook Street	Oak St. to Main St.
	Jackson Street	Oak St. to Main St.
	Campbell Street	Muhammad Ali Blvd. to Main St.; Finzer St. to Broadway
	Logan Street	Oak St. to Finzer St.
Southbound	Eighth Street	Market St. to Kentucky St.
	Sixth Street	Main St. to Oak St.
	Third Street	Main St. to Oak St.
	First Street	Main St. to Oak St.
	Preston Street	Main St. to Broadway
	Shelby Street	Main St. to Oak St.

Traffic Simulation Models

A downtown Louisville traffic simulation model was previously created for other Louisville Metro Government studies. The model was created using the TransModeler simulation modeling software, developed by Caliper Corporation. The original model, which was developed for the analysis of the Kennedy Interchange, Section 1 of the Louisville-Southern Indiana Ohio River Bridges Project (LSIORB), was expanded in 2007 to include a larger portion of downtown and western Louisville. The limits of the overall model are shown in **Figure 2**.

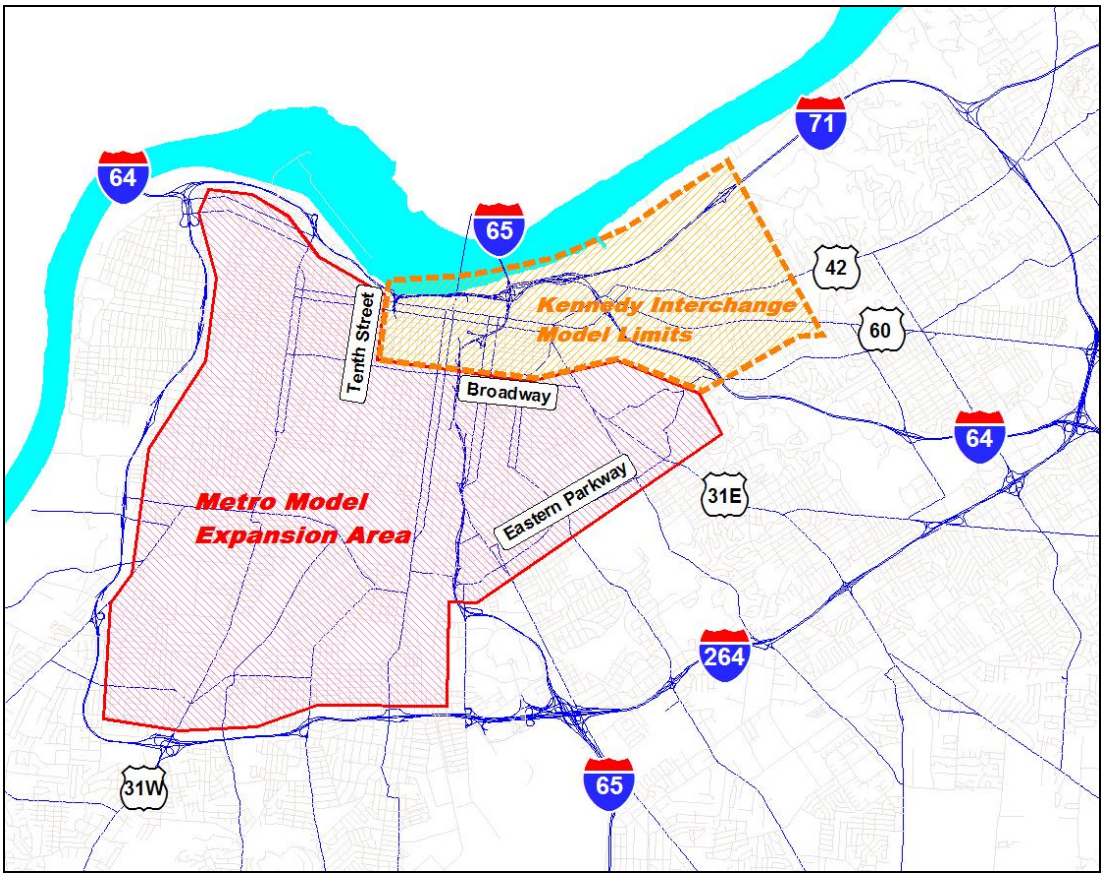

Figure 2: Louisville Metro Traffic Simulation Model Area

The 2007 traffic model was utilized as the foundation for this two-way street analysis. A thorough calibration was completed for the downtown area so that it reflected existing peak hour traffic conditions. Calibration measures included turning volumes, travel times and queue lengths.

Development of Alternatives

Through meetings with DDC and Louisville Metro Public Works, alternative two-way scenarios were developed. These scenarios include:

1. Base Scenario - This scenario includes the existing street system plus those improvements or modifications that are committed or assumed to be in place by the analysis year, representing the Existing Plus Committed ("E+C") alternative. Streets assumed to be converted to two-way will include:
    - Jefferson Street from Brook Street to Baxter Avenue
    - Shelby Street
    - Campbell Street
    - 7th Street
    - 8th Street
2. An "Ultimate" scenario, where all feasible one-way streets are converted to two-way.
3. A Final scenario, which is considered to be a compromise between the E+C and Ultimate Scenarios.

ENTRAN has performed two-way conversion studies for a number of facilities within downtown previously for Louisville Metro Public Works. These facilities include 7th Street and 8th Street west of I-65, and Jefferson Street, Shelby Street, and Campbell Street east of I-65. Each of these studies found such conversions would be feasible. Therefore, it was assumed that such changes were likely to occur and were therefore included in the E+C Scenario.

Louisville Metro, with the assistance of another consultant, had investigated improvement options for the Jefferson Street/Brook Street exit from I-65. The current configuration for the exit includes a split ramp for separate access to northbound Brook Street and westbound Jefferson Street. The proposed modification includes modifying the exit ramp so that it connects to Jefferson Street mid-block between Brook Street and Floyd Street. Jefferson Street would remain one-way west of the exit ramp and would be converted to two-way east of the ramp to Baxter Avenue. This configuration, as shown in **Figure 3**, was included in the analysis.

There are some limited exceptions to all one-way streets being converted to two-way traffic under the Ultimate Scenario. The existing access from 1st Street to southbound I-65 and from northbound I-65 to Brook Street makes converting those streets difficult. All the ramps from 1st Street and to Brook Street are configured for one-way flow, and reconfiguring them for access to/from two-way streets would require significant modifications to the ramps. Such modifications would likely require an Interchange Justification Study (IJS) be performed to ensure necessary modifications would not degrade operations of the interstate system through downtown. Therefore, it was assumed that for the purposes of this study, 1st Street and Brook Street will remain one-way.

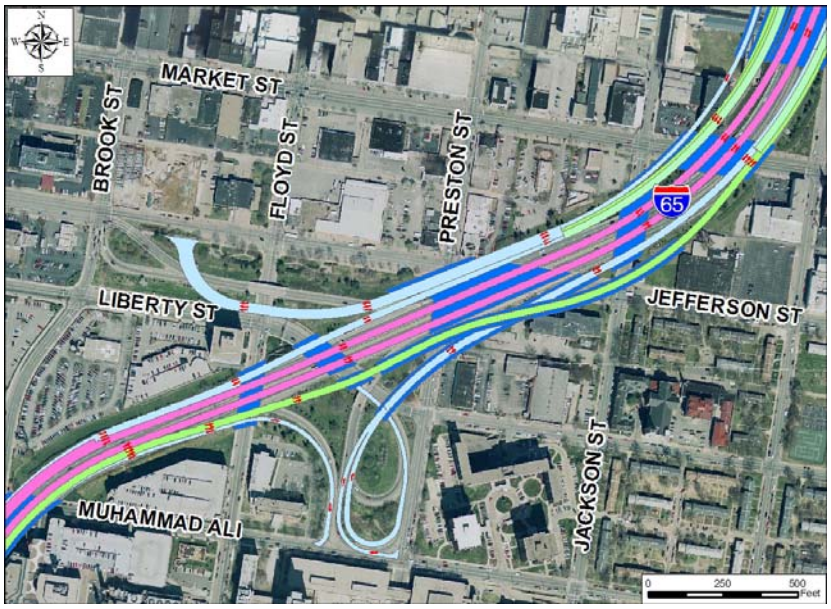

Figure 3: Proposed I-65 Access at Jefferson/Brook Street

(Source: Interchange Justification Study Addendum for the Kennedy Interchange)

The proposed configuration for the Kennedy Interchange assumes that the 3rd Street exit from westbound I-64 will be removed near the completion of the reconstruction project. It will be replaced with a new exit ramp onto River Road near I-65. However, this exit will not be available from southbound I-65, and the reconfigured Jefferson Street exit will serve as the primary access into downtown from southbound I-65. As the future travel demand at this exit is anticipated to increase, it was not considered feasible to convert Jefferson Street west of the exit ramp to two-way traffic. Therefore, Jefferson Street west of I-65 was assumed to remain one-way in the westbound direction.

Traffic forecasts were developed for a 2010 horizon year, representing the earliest likely timeframe for which some two-way conversions could be implemented. The regional travel demand model developed by the Kentuckiana Regional Planning and Development Agency (KIPDA), the local Metropolitan Planning Organization (MPO) for Louisville, was used to determine anticipated traffic growth rates throughout the downtown street system. Additional traffic was assumed for the proposed Museum Plaza development, a large-scale mixed use development planned for the area north of Main Street between 7th Street and 9th Street. The plans for this development include the extension of River Road west of 9th Street, new traffic signals at the River Road intersections with 6th Street and a reconstructed 8th Street, and the closure of 7th Street north of Main Street. Seventh Street has been closed within the last year, but will eventually provide access into the development.

The relevant downtown streets were then converted to two-way for each scenario's simulation model. Demand for travel was assumed to remain constant throughout the model area. That is, it was assumed the number of trips though the model area would remain constant between scenarios, regardless of the changes included in each scenario. Where streets were converted to two-way, this means that new routes are available to accommodate the travel demand.

Some general guidelines were used in determining the likely geometry of new two-way streets. The elimination of on-street parking was not considered feasible. A minimal number of on-street parking spaces could be removed only if necessary to accommodate a needed turn lane at an intersection. One example is along Muhammad Ali Boulevard west of 5th Street, where parking was removed from one side of the street to accommodate a continuous center left turn lane. Elsewhere, it was assumed that no additional lanes would be provided. If a one-way street currently has four lanes, it was assumed that two travel lanes would be provided in each direction. Generally speaking, where three lanes are provided today, a single lane would be provided in the new direction of flow and two lanes would remain to serve the current direction of flow. An example of this is along Main Street west of 6th Street. Finally, no existing turning options would be eliminated under a two-way scenario.

During the recalibration of the two-way simulation models, travel speeds along the converted two-way streets for the new directional flow of traffic were decreased slightly to better depict the tendency for commuters to travel the same directional routes they were driving before the street conversions. While keeping the demand of the origins and destinations constant for the network, TransModeler generated new turning movement volumes for the entire network to reflect the travel pattern changes. These revised volumes were then used to optimize traffic signal timings to accommodate the two-way traffic within the study area. Public Works provided a SYNCHRO model containing much of the downtown street system with current volumes and signal timings. This model was expanded to include the entire model area and used to develop updated signal timings. Existing cycle lengths for the A.M. and P.M. peak hours were held constant.

Preliminary Findings

A number of issues were found with the Ultimate Scenario. It was generally found that the Ultimate Scenario could accommodate the demand for travel during the A.M peak hour of travel, but traffic conditions deteriorated significantly during the P.M. peak. **Figure 4** depicts some of the more problematic locations where anticipated congestion was deemed unacceptable and opportunities to provide additional needed capacity are limited. Each of these locations is restricted by the available street width and/or the existence of on-street parking.

These problem locations include the following street segments:

1. **Muhammad Ali:** 3rd Street to 5th Street
2. **Floyd Street:** Muhammad Ali to Main Street
3. **Liberty Street:** 2nd Street to 5th Street
4. **Main Street:** 6th Street to 9th Street
5. **3rd Street:** Main Street to Liberty Street

Muhammad Ali Boulevard consists of two travel lanes between 3rd Street and 5th Street, as shown in **Figure 5**. Without removing on-street parking, it is not possible to accommodate more than two travel lanes with two-way traffic. This resulted in significant congestion during the P.M. peak period of travel. The section of Muhammad Ali between 3rd and 5th streets is approximately 34 feet wide from curb to curb and has parking on both sides of the street. Even if this parking were eliminated, accommodating left turn lanes would be impractical due to the street width. In addition, the turning radius from southbound 3rd Street to westbound Muhammad Ali is not sufficient for commercial vehicles as delivery trucks currently tend to turn into the left lane from 3rd Street. Under two-way traffic, it would be difficult to accommodate this movement.

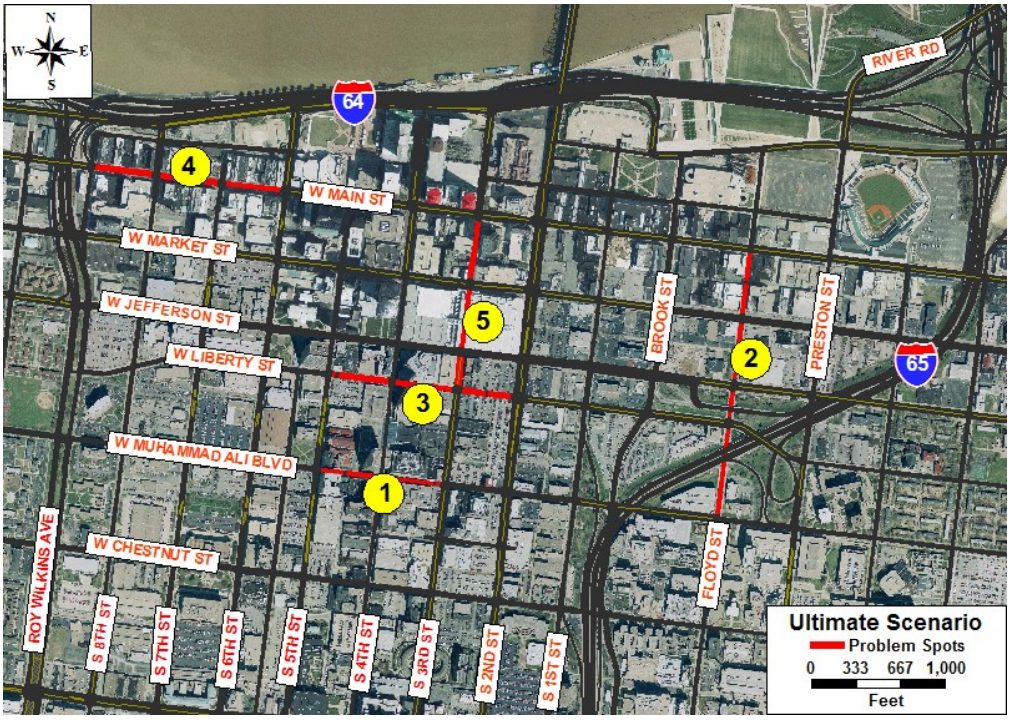

Figure 4: Problem Locations in the Ultimate Two-Way Scenario

Figure 5: Muhammad Ali west of 3rd Street

Floyd Street currently serves a significant volume of traffic, particularly during the P.M. peak, as it provides access to the medical center. With the proposed changes to the southbound I-65 exit at Jefferson Street, the demand for travel on southbound Floyd Street increases during the A.M. peak as traffic destined for the medical center will be able to turn right from the exit ramp and then turn right onto southbound Floyd Street. Floyd Street is two-lane with parking south of Jefferson Street, as shown in **Figure 6**, and two lanes is not anticipated to be capable of accommodating the future demand.

Figure 6: Floyd Street at Muhammad Ali

The on-street parking north of Muhammad Ali is not heavily utilized, and it is assumed that it could be eliminated to accommodate additional travel lanes. This could provide two southbound lanes to Muhammad Ali, where traffic destined for the Jewish Hospital parking garage can turn right onto Muhammad Ali and traffic destined for Norton or Kosair Hospital parking can continue south on Floyd Street.

Liberty Street currently has three eastbound lanes west of 2nd Street as shown in **Figure 7**, at which point it becomes four lanes. The P.M. peak simulation model, which assumed two eastbound lanes and a single westbound lane, showed significant congestion between 2nd Street and 4th Street. Liberty Street carries a heavy volume of traffic during the P.M. peak hour as it provides access to northbound I-65 east of Floyd Street. This volume of traffic necessitates two eastbound through lanes, but that precludes the construction of a left turn lane from Liberty Street to northbound Second Street.

Figure 7: Liberty Street east of 3rd Street

The current traffic demand for the eastbound through movement at 2nd Street during the P.M. peak hour is nearly 800 vehicles per hour and the left-turn

volume is just less than 200 vehicles per hour but increases slightly under a two-way scenario. This demand is difficult to accommodate with two travel lanes, particularly without the benefit of a dedicated left-turn lane at the traffic signal at 2nd Street. Removal of the parking along the north side of the street in the area would not provide adequate width for four lanes as the street is approximately 39 feet wide between the curbs.

Main Street currently transitions from four westbound lanes to three lanes at 6th Street, as shown in **Figure 8**. As Main Street provides access to I-64 at 9th Street, the demand for westbound travel is high during the P.M. peak hour. It was assumed that a two-way Main Street could accommodate two westbound lanes and a single eastbound lane west of 6th Street, but turn lanes could not be accommodated at intersections. The heavy demand for westbound travel, exacerbated by increased traffic generated by the Museum Plaza development, coupled with the lack of turn lanes resulted in significant congestion along western portions of Main Street.

Figure 8: Main Street at 7th Street

Third Street currently consists of two southbound lanes with on-street parking between Main Street and Liberty Street, as shown in **Figure 9**. This segment, which includes a "viaduct" section beneath the Kentucky International Convention Center, cannot accommodate more than two travel lanes. Accommodating left-turn lanes at Jefferson Street and Liberty Street would not be possible under a two-way scenario, and the southbound capacity at Market Street would be diminished. The current intersection configuration includes a left-turn lane, a shared left and through lane, and a through lane. Under the two-way scenario, only a single through lane and a short left-turn lane could be provided.

Figure 9: 3rd Street north of Liberty Street

Another issue related to 3rd Street is its importance in the coming years during the reconstruction of the Kennedy Interchange. The current maintenance of traffic plans for the project attempt to maintain as many interstate lanes and interchanges as possible throughout construction, but require the complete closure of the Jefferson Street exit from southbound I-65 for a period of time, as well as periods where only limited access is provided. During these periods, the demand for access at 3rd Street will increase, particularly during the A.M. peak period of travel as commuters are entering downtown. Therefore, in the short-term, converting this section of 3rd Street to two-way would likely result in significant congestion.

Discussions with DDC and Public Works in the summer of 2008 revealed other issues with the Ultimate two-way scenario. Main Street and Market

Street currently serve as detour routes in the event of an incident on I-64 through downtown. In their current one-way configurations, these facilities can reasonably accommodate the demand for travel in the event of an interstate closure. However, the lack of turn lanes and decrease in through capacity under two-way traffic would significantly diminish the ability for these streets to accommodate such demand in the future.

Parking garage access and operations is a concern for several facilities. (Four additional parking garages are currently planned in the downtown area and will also have to be considered.) In the case of 5th Street, potential impacts to the large number of TARC routes that travel that street and impacts to parking garage operations south of Liberty Street would have to be investigated further. East of I-65, Preston Street would be difficult to convert as it serves University of Louisville Hospital and will carry additional traffic in the future when the proposed River Road exit ramp is open to traffic. With that ramp in place, River Road and Preston will provide a more-direct connection for southbound vehicles traveling to one of the area hospitals.

Delivery vehicles present another obstacle. Currently, many delivery vehicles will stop in a traffic lane for a brief period of time to unload parcels. This is not a significant issue on a one-way street as vehicles can use the adjacent lanes to pass. However, as many streets would not have more than one lane in each direction with two-way traffic, delivery vehicles would completely stop traffic flow in one direction if they were to stop in a travel lane.

Final Scenario

With issues such as those previously discussed, there is a limited number of streets that are currently considered feasible for conversion to two-way traffic flow. Other than those streets already included in the Base (E+C) Scenario, namely 7th and 8th streets, Jefferson Street east of I-65 and Shelby and Campbell streets, west of I-65 only 6th Street appears to be a suitable candidate. South of Broadway, there are no significant issues with converting the remaining one-way east-west streets to two-way, with the exception of St. Catherine near I-65. The I-65 interchange would be difficult to accommodate efficiently with St. Catherine being two-way between 1st Street and Preston Street. Based on preliminary analyses, converting streets or street segments to two-way traffic east of I-65 appears to be feasible. Most of these streets experience lighter peak hour traffic volumes with fewer turning movements at the intersections.

A working meeting with DDC and Public Works was held in November 2008 to discuss the development of the Final Scenario for analysis. It was decided that Jackson Street would provide a logical point to begin two-way traffic along the east-west streets north of Broadway. In addition, discussions related to the development of the Louisville Downtown Arena brought to light other considerations in the vicinity of Main Street and 2nd and 3rd streets. The Final scenario adds to the Base Scenario the conversion of the following street segments:

- Main Street between Second Street and Baxter Avenue
- Liberty Street between Jackson Street and Baxter Avenue
- Muhammad Ali Boulevard between Jackson Street and Chestnut Connector
- Chestnut Street between Jackson Street and Chestnut Connector
- Third Street between Main Street and Market Street
- Second Street between River Road and Washington Street

Also, the Final Scenario includes the closures of Second Street between Main Street and Washington Street and Washington Street between 2nd Street and 3rd Street (this segment has already been removed for construction of the Louisville Arena).

A number of assumptions were required in developing a simulation model for the Final Scenario.

At the 2nd Street and Main Street intersection, dual left turns would be warranted for the northbound approach to accommodate the demand for access to westbound Main Street. (One option for the intersection that could be considered is to operate with dual left turn lanes during the peak period and as single turn lanes during off-peak periods.) The northbound through movements to the Clark Memorial Bridge would be slightly misaligned if the current cross section and striping were maintained. However, there are options that could be explored to improve that issue, such as moving the south approach slightly to the west.

Accommodating left turns from the bridge onto the proposed westbound Main Street would be difficult as it would result in no more than a single left-turn lane and a through lane on the bridge. It was decided that left turns would not be allowed onto westbound Main Street as drivers wishing to travel in that direction could turn left onto Market Street, the next intersection to the south. The existing dual right turn lanes on the southbound approach from the bridge present somewhat of a safety issue for pedestrians crossing 2nd Street, and pedestrian volumes are expected to increase once the Louisville Arena is open. Although a single right turn lane would result in longer queues on the bridge, particularly during the morning peak hours, the increase would likely be negligible as the outer lane is currently less than 200 feet long and does not significantly increase the capacity for that movement.

Baxter Avenue at Main Street presents a unique situation as it is where four one-way streets converge. Story Avenue approaches from the east and Mellwood Avenue departs to the east. Main Street departs to the west and Baxter Avenue approaches from the south. Under the current one-way configuration, an island provides positive separation between all movements and no traffic control devices are required. It was assumed that if the west leg of the intersection was converted to two-way traffic, the approaches would have to be reconfigured and a traffic signal would be required to accommodate all proposed turning movements. A roundabout could be considered as a potential alternative for the intersection, but right-of-way requirements would have to be explored further.

At the Liberty Street and Baxter Avenue intersection, the southbound right turn would be difficult for vehicles due to the skew angle of the intersection. As the anticipated demand for that turning movement volume would be minimal, it was decided to not allow the southbound right turn at the intersection.

As part of this study, ENTRAN was asked to investigate the impacts to parking garage access due to the two-way street conversion. Two parking garages were identified as being impacted by the Final Scenario. The first garage is the 420-space Actors Theater Garage on Third Street north of Market Street. It was decided that Third Street access to the garage, assuming this segment of Third Street is converted to two-way traffic flow, would be provided as right-in/right-out only. The second garage discussed was the 647-space First and Main garage. Currently, access is provided on both First Street and Main Street. With the conversion of Main Street to two-way traffic, it is recommended that the Main Street access be provided as right-in/right-out only. Existing access would remain as-is on First Street.

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Alternatives Analysis

This section details the results of the traffic simulation models developed to replicate the two-way traffic scenarios for downtown Louisville. The results discussed here support the conclusions presented in the previous section.

Performance Measures

A number of performance measures are available from the traffic simulation model output that can be used to describe the anticipated travel characteristics of a given scenario. **Table 2** includes the system-wide performance measures, that is, measures that reflect average traffic conditions throughout the entire model network that are used for this study.

Table 2: Performance Measures

Performance Measure	Description
Percent Completed Trips	The percentage of trips that were initiated and completed within a one-hour simulation model run.
Vehicle-Hours Traveled (VHT)	The sum total travel time experienced by all vehicles.
Vehicle-Miles Traveled (VMT)	The sum total distance traveled by all vehicles.
Average Speed	Travel speed averaged over all vehicles.
Delay	Total difference between experienced travel time and free flow travel time, summed over all vehicles.

Vehicle-hours of travel (VHT) is the sum of total travel time by all vehicles traveling through the network during the simulation period. Vehicle-miles of travel (VMT) is the sum of the total distance traveled by all vehicles in the model network during each 60-minute analysis period (A.M. peak and P.M. peak). Average speed is defined as the travel speed averaged over all vehicles that travel through the network during the simulation period. Average speed includes time stopped at traffic signals; it is equivalent to traveling at a lower constant speed without stopping. Delay (in hours) represents the difference in actual travel time compared with an unimpeded, free-flowing travel time through the network during the simulation period.

Traffic Simulation Results

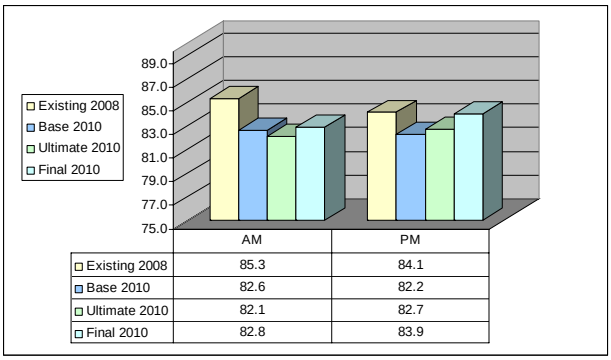
For each of the performance measures, graphics and tables have been prepared comparing the A.M. and P.M. peak periods for the existing condition (2008), the Base Scenario (2010), the Ultimate Scenario (2010), and the Final Scenario (2010). **Table 3** presents a summary of the traffic volumes, by direction of travel from the traffic simulation output for each model scenario. These hourly traffic volumes represent the traffic flow along all segments through the block between Jackson Street and Hancock Street.

Table 3: Traffic Simulation Output Volumes between Jackson Street and Hancock Street

AM Peak Hour				
Roadway	**Existing 2008**	**Base 2010**	**Future 2010**	**Final 2010**
EB Main St.	----	----	125	125
WB Main St.	1420	1370	635	830
EB Liberty St.	120	65	75	100
WB Liberty St.	----	----	360	55
EB Muhammad Ali	----	----	85	10
WB Muhammad Ali	410	440	570	375
EB Chestnut St.	295	295	165	155
WB Chestnut St.	----	----	255	55
PM Peak Hour				
Roadway	**Existing 2008**	**Base 2010**	**Future 2010**	**Final 2010**
EB Main St.	----	----	220	300
WB Main St.	855	840	505	820
EB Liberty St.	400	200	200	235
WB Liberty St.	----	----	175	40
EB Muhammad Ali	----	----	130	25
WB Muhammad Ali	305	340	250	250
EB Chestnut St.	925	865	575	510
WB Chestnut St.	----	----	190	45

In most cases, the "new" direction of travel under a two-way scenario does not see a significant amount of traffic in the Ultimate and Future scenarios. In the A.M. peak hour, westbound traffic volumes on Main Street are significantly lower with two-way traffic, suggesting that other route options are likely serving trips that would have used Main Street.. Eastbound Muhammad Ali does not appear to experience significant demand if the street were to be converted to two-way.

The Percent Completed Trips for each of the model scenarios is shown in **Figure 10**.

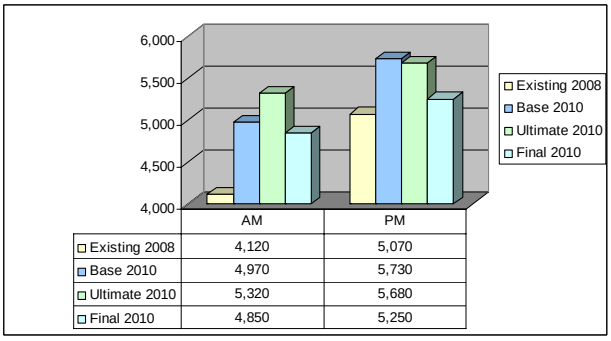


	AM	PM
Existing 2008	85.3	84.1
Base 2010	82.6	82.2
Ultimate 2010	82.1	82.7
Final 2010	82.8	83.9

Figure 10: Percent Completed Trips

The simulation software will never return a value of 100% for percent completed trips as there will always be trips that are left incomplete as vehicles remain in the network at the end of the one-hour model run. However, higher percent completed trips indicate an alternative is better able to accommodate the travel demand. Fewer trips were completed in each of the 2010 scenarios as compared to the existing scenario because there was more traffic in the future year simulation scenarios, thus more congested routes. In each case, the Final Scenario resulted in a higher percentage of completed trips than the Base or Ultimate Scenario.

Figure 11 shows the total VHT for each model scenario for all trips.

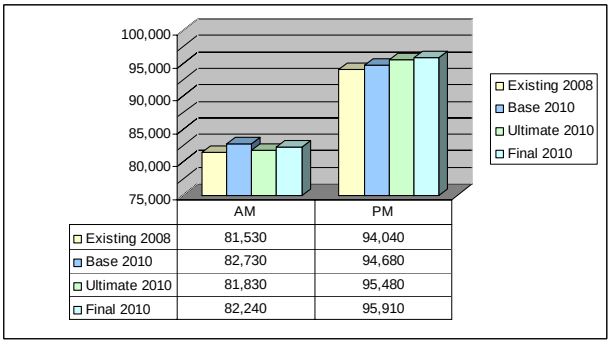


	AM	PM
Existing 2008	4,120	5,070
Base 2010	4,970	5,730
Ultimate 2010	5,320	5,680
Final 2010	4,850	5,250

Figure 11: Total Vehicle-Hours of Travel (VHT)

Total vehicle-hours of travel increase when comparing the existing to any of the future scenarios. This is logical as the 2010 traffic forecasts are higher than existing volumes. The Final Scenario results in the lowest VHT among the future scenarios, suggesting that overall traffic performance will be better than under the Base or Ultimate scenarios.

Figure 12 shows the total VMT for each model scenario for all trips.



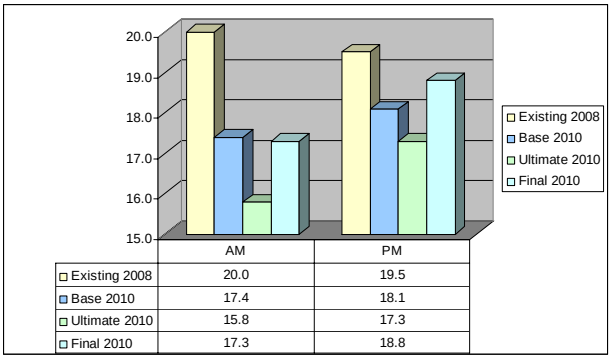
	AM	PM
Existing 2008	81,530	94,040
Base 2010	82,730	94,680
Ultimate 2010	81,830	95,480
Final 2010	82,240	95,910

Figure 12: Total Vehicle-Miles of Travel (VMT)

At a study area level, total vehicle-miles of travel do not significantly increase from the existing to the future scenarios. As more trips are completed during each of the peak hours, VMT should increase. While it was noted that VHT increases significantly from 2008 to the 2010 alternatives, it is reasonable to assume that some trips will be shorter with two-way streets as they tend to minimize circuitous travel to reach a final destination. Another explanation is that

many of the two-way streets tend to be more congested, which minimizes the amount of travel through the network.

Figure 13 shows the average travel speed for each model scenario for all trips.

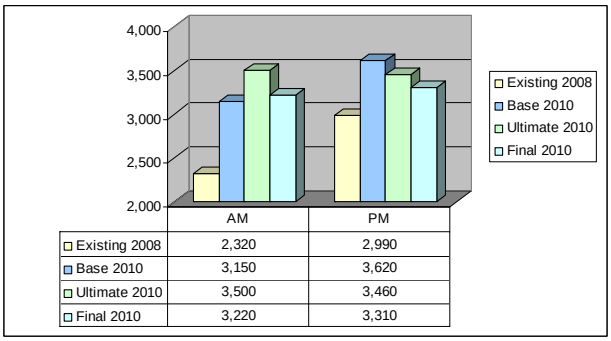


	AM	PM
Existing 2008	20.0	19.5
Base 2010	17.4	18.1
Ultimate 2010	15.8	17.3
Final 2010	17.3	18.8

Figure 13: Average Speed (MPH)

Average travel speeds decrease significantly between the existing and future scenarios. The Ultimate Scenario resulted in the lowest average travel speeds. In the A.M. peak, the Base and Final scenarios performed similarly; however, the Final Scenario performed significantly better than the Base Scenario in the P.M. peak.

Figure 13 shows the total delay for each model scenario for all trips.



	AM	PM
Existing 2008	2,320	2,990
Base 2010	3,150	3,620
Ultimate 2010	3,500	3,460
Final 2010	3,220	3,310

Figure 14: Total Delay (Hours)

Total delay does not differ significantly between the Base and Final scenarios in the A.M. peak, but delay in the P.M. peak is significantly lower for the Final Scenario.

Intersections of Interest

Selected intersections were evaluated to determine their likely performance under the model scenarios. These intersections were selected because they represent locations that are currently congested during the peak hours of travel or they were deemed to be potentially congested under two-way traffic. The intersection statistics are not necessarily as meaningful as other statistics because delay is only measured for vehicles that can reach and pass through an intersection. If congestion occurs somewhere upstream of an intersection and prevents traffic from reaching the intersection in question, then the approach delays may be misleading.

Table 4 presents a summary of the average delays (in seconds per vehicle) for five selected intersections for the A.M. and P.M. peak hours.

Table 4: Average Delay (seconds per vehicle) at Selected Intersections

AM					
Intersection		Existing 2008	Base 2010	Future 2010	Final 2010
Main Street @	Preston St.	8.7	10.2	18.2	12.1
	2nd St.	18.1	15.5	46.1	20.5
	3rd St.	12.1	13.0	17.5	18.4
River Road @	2nd St.	35.0	39.2	46.7	43.7
	3rd St.	28.8	52.8	30.3	29.6
PM					
Intersection		Existing 2008	Base 2010	Future 2010	Final 2010
Main Street @	Preston St.	7.0	7.8	15.7	15.0
	2nd St.	32.4	45.2	38.8	17.6
	3rd St.	12.9	22.2	13.7	13.1
River Road @	2nd St.	31.7	38.8	34.8	33.3
	3rd St.	18.2	74.7	44.7	55.4

In most cases, each intersection is anticipated to experience slightly more delay under the two-way traffic scenarios than under the Existing or Base scenarios. However, the anticipated delays at these intersections appear to be acceptable under two-way traffic.

Travel Times

Estimated travel times were extracted from the model output for each model scenario. **Figure 15** presents a composite summary of the travel times along the east-west streets between Second Street or Jackson Street and Baxter Avenue or the Chestnut Connector.

As would be expected with additional traffic downtown, travel times appear to increase between the existing condition and the future scenarios, with the largest increase occurring along westbound Main Street. However, the Final Scenario tends to compare favorably to both the Existing and the Base scenarios.

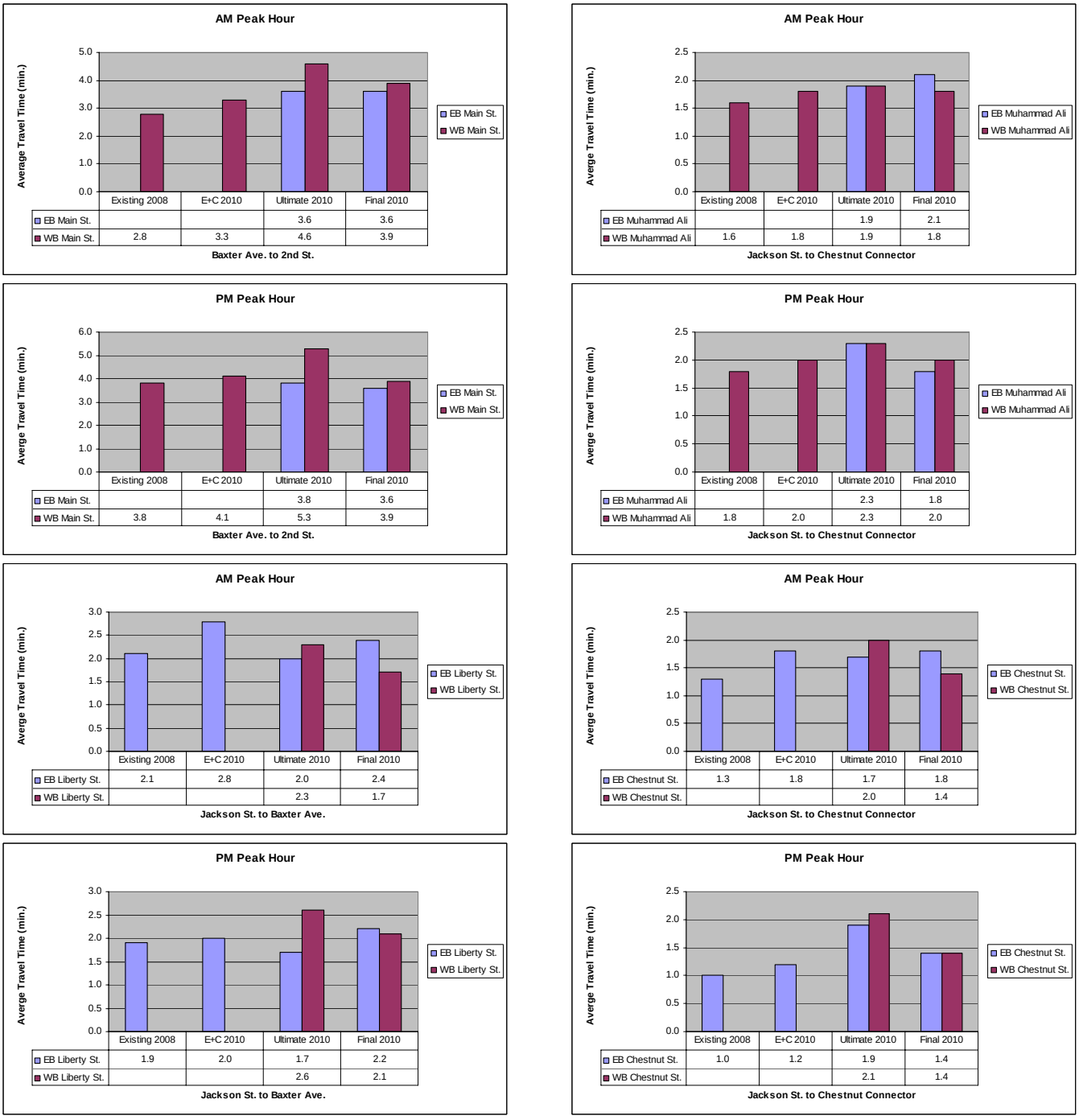


Figure 15: Average Travel Times (Minutes)

Conclusions

This section summarizes the findings from the Downtown Louisville Two-Way Street Study and makes recommendations for next steps.

As demonstrated, traffic impacts are only one of a number of issues that must be considered in determining the feasibility of converting one-way streets to two-way traffic. Adequate traffic conditions can most likely be maintained on many of the streets under consideration in the Ultimate Scenario, but the costs and impacts associated with modifying these streets to better accommodate two-way traffic flow likely will be considerable.

The evaluation of the Final Scenario suggests that converting each of the east-west streets to two-way traffic flow east of Jackson Street should provide adequate traffic performance. This conclusion is based on currently available information and does not include any significant development along the street segments in question.

Outstanding Issues

Converting Main Street to two-way traffic between 2nd Street and Jackson, closing 2nd Street between Main Street and Washington Street, and converting 3rd Street to two-way between Main and Market appears to be feasible with current land use in the area. However, proposed changes in the vicinity may affect the feasibility of these modifications.

The Louisville Arena Authority is currently constructing a 22,000-seat arena with a 760-space underground parking garage in the block bounded by Main Street and River Road and 2nd and 3rd streets. The parking garage will serve monthly parkers during the day and will accommodate special event goers in the evenings and on the weekends. A number of questions regarding access to the site remain unanswered, but the current thinking is that this garage will have public access on 3rd Street only. In addition, a proposed parking garage with between 800 and 1,000 parking spaces west of 3rd Street will also have a significant effect on traffic in the vicinity as it too is proposed to have access to 3rd Street only. These two sites are shown in **Figure 16**. Additional redevelopment along Main Street east of 2nd Street is also likely to occur in the future as a result of the arena development, further complicating the issue.

Figure 16: Louisville Downtown Arena Site and Proposed Parking Garage west of 3rd Street

The details regarding these developments must be better understood before a determination of feasibility can be made for modifying the street system in the vicinity. The Arena Authority intends to conduct a study to develop a traffic management plan for special events at the arena. An additional study has also been suggested to investigate the daily impacts associated with two new parking garages on travel patterns in the area. These studies must be performed prior to making final recommendations for the proposed changes to Main Street (west of Jackson Street), 2nd Street, and 3rd Street.

Cost Estimates and Implementation

Planning-level cost estimates have been developed for the complete Final Scenario, with the exception of converting Main Street to two-way between Jackson and 2nd Street and removing 2nd Street north of Main

Street. The conversion of Jefferson Street east of the proposed I-65 exit ramp is included, but not the costs associated with the ramp itself. It was assumed that all one-way to two-way conversions would coincide with the repaving of each roadway in order to provide clear pavement markings and improved signage to accommodate two-way traffic flow. For purposes of these estimates, a 1.5 inch mill and asphalt overlay was assumed. Upgrading existing traffic signals or installing new signals was assumed to cost $40,000 per intersection. A 20-percent contingency was included to account for unknowns associated with the proposed changes.

The estimated costs associated with the Final Scenario are summarized in **Table 5**. The construction costs include paving, striping, providing additional signage, and upgrading the traffic signals along each street. In addition, 4.5 percent is included for contractor mobilization and demobilization. A 20-percent contingency is on top of the construction costs, but is not included on top of the mobilization and demobilization costs. Costs associated with maintenance of traffic are not included.

Table 5: Cost Estimates

Street	Segment	TOTAL COST
Main Street*	2nd Street to Story Ave./Baxter Ave.	$ 600,000
Jefferson Street**	I-65 to Baxter Avenue	$ 60,000
Liberty Street	Jackson Street to Baxter Avenue	$ 510,000
Muhammad Ali	Jackson Street to Chestnut Connector	$ 435,000
Chestnut Street	Jackson Street to Chestnut Connector	$ 460,000
3rd Street	Main Street to Market Street	$ 127,000
TOTAL		$ 2,192,000

**Note: Does not include cost to reconfigure the Main Street intersection with Baxter Avenue, Story Avenue, and Mellwood Avenue, other than installing a traffic signal.*
***Per Louisville Metro Public Works and Assets.*

The total cost to implement the two-way conversion is approximately $2.2 million.

Implementation

It typically makes sense to convert one-way couplets (i.e. existing one-way streets that parallel one another and serve opposite directions of traffic flow) to two-way traffic in pairs. In the case of Main Street, the accompanying sections of Market Street are currently two-way. Therefore, Main Street between Jackson Street and Baxter Avenue can be converted by itself. If the studies related to the Louisville Arena and adjacent developments suggest that converting Main Street between Jackson Street and 2nd Street is feasible, that conversion could take place at a later date. Maintaining the existing bicycle lane on Main Street in a westbound-only direction is considered acceptable as the Market Street corridor currently serves eastbound bicycle traffic.

It would make sense to convert Jefferson Street and Liberty Street to two-way traffic concurrently as they serve as a couplet. The Jefferson Street conversion could take place in stages, if desired, to accommodate the future construction of the exit ramp from I-65. The initial section could include the section between Floyd Street and Baxter Avenue. Muhammad Ali and Chestnut Street could be converted concurrently.

Appendix: Meeting Summaries

Meeting Summary

TO: Patti Clare
Downtown Development Corporation

FROM: Tom Creasey, P.E.
ENTRAN, PLC

DATE: June 23, 2008

SUBJECT: Downtown Louisville Two-Way Street Analysis
Project Status Meeting

A project status meeting was held at the Downtown Development Corporation's office at 9 a.m. on Friday, June 13, 2008. The focus of the meeting was: (1) to discuss the preliminary results of the study currently underway to examine the feasibility of converting the existing one-way streets in downtown Louisville to two-way traffic flow; (2) to discuss potential street modifications to better accommodate two-way flow; and (3) to discuss a final analysis scenario to include streets that could most likely function as two-way. The following individuals were in attendance:

Patti Clare	Downtown Development Corporation
Ethan Howard	Downtown Development Corporation
Pat Johnson	Louisville Metro – Public Works
Stacy Keith	Louisville Metro – Public Works
Dave Marchal	Louisville Metro – Planning and Design Services
Rick Storm	Louisville Metro – Public Works
Brian Aldridge	ENTRAN, PLC
Tom Creasey	ENTRAN, PLC
Ashley Day	ENTRAN, PLC

Tom Creasey began the meeting with an introduction and brief history of the previous downtown two-way street conversion studies. Brian Aldridge delivered a brief presentation of the preliminary results with the group. He began the presentation by summarizing the goals of the meeting, which were to discuss the traffic simulation results, to discuss street modifications necessary to better accommodate two-way traffic, and to discuss the final scenario where only the streets deemed feasible for two-way traffic will be analyzed.

Three scenarios have been investigated thus far. The existing conditions have been analyzed using traffic volume and signal data provided by Traffic Engineering. An existing-plus-committed ("E+C") alternative was developed that included several one-way streets currently planned (i.e. "committed") for conversion to two-way traffic. These include 7th and 8th streets, Shelby and Campbell streets, and Jefferson Street between Floyd Street and Baxter Avenue. Projected traffic volumes in this scenario reflected anticipated conditions in 2010, including traffic associated with the Museum Plaza development on West Main Street and the proposed River Road extension west

of 9th Street. The final scenario, referred to as the "ultimate" scenario, included conversion of all existing one-way streets within the downtown area to two-way traffic, with the exception of 1st Street and Brook Street (because of their interchanges with I-65) and Jefferson Street west of the proposed exit ramp from I-65 that will tie into Jefferson Street mid-block between Brook Street and Floyd Street. Traffic volumes reflecting conditions in 2010 were also used to analyze this scenario. A.M. and P.M. peak hour traffic simulation models were developed for the analyses.

In the two-way scenarios, minimal changes were made to the street networks to accommodate the new traffic patterns. Traffic signals were re-timed using existing or similar cycle lengths and phasing sequences. Where possible, no parking was eliminated and only existing lanes were used to carry traffic. One exception was along Muhammad Ali Boulevard west of 5th Street, where parking was removed from one side of the street to accommodate a continuous center left turn lane. Finally, the demand for travel was assumed to be constant in the future. That is to say, motorists traveling from a particular origin to a destination today will try to continue using the same or next nearest route in the future.

Performance measures were discussed at the intersection, street/corridor, and study area level. Several "critical" intersections were considered as they are currently congested during one or more peak hours, or are likely to be congested under two-way traffic as turn lanes cannot be accommodated due to physical constraints. The 2nd Street intersection with Main Street was discussed as an example, and it was shown that, as two-way, approach delays will increase significantly in the morning peak hour and increase slightly in the afternoon. Brian noted that statistics other than intersection delay are equally meaningful because delay is only measured for vehicles that can reach and pass through an intersection. If congestion occurs somewhere upstream of an intersection and prevents traffic from reaching the intersection in question, then approach delays may be misleading. He stated that this makes the street and study area level performance issues more important to the analysis.

At the street analysis level, Brian stated that for most streets, the models suggest travel times will increase and travel speed will decrease under a two-way scenario. Main and Market streets were given as examples, and bar charts were shown depicting the existing and ultimate two-way scenarios. Pat Johnson questioned the negligible increase in the P.M. travel time for a two-way Market Street, stating that he believed travel times would be significantly worse with two-way traffic. Brian stated that ENTRAN would review those results, and since that time found there was an error in the reported data. In actuality, travel times do increase with the two-way scenario and the presentation was updated and distributed to attendees.

At a study area level, total vehicle-miles of travel significantly decrease from the existing to the ultimate scenario. One possible explanation is that some trips will be shorter with two-way streets as they tend to minimize circuitous travel to reach a final destination. Another explanation is that many of the two-way streets tend to be more congested, which minimizes the amount of travel through the network.

Total vehicle-hours of travel decrease slightly when comparing the existing to the ultimate scenario. Total delay does not differ significantly between the existing and ultimate scenario in the A.M. peak as the typical morning rush hour does not result in significant congestion on the majority of the city streets within the study area, but delay does increase under the two-way scenario in the P.M. peak. While this may appear to demonstrate that traffic conditions under the two-way scenario will not be significantly worse than existing conditions, these statistics are reported only for the completed trips during the peak hour. Completed trips are those that are able to successfully enter and exit the model after traveling between a particular origin and destination.

A smaller percentage of trips are completed in both the A.M. and P.M. peak under the two-way scenario compared to the existing conditions. This means that additional congestion that occurs as a result of converting streets to two-way causes a spreading or lengthening of the P.M. peak period.

Brian continued by saying that traffic performance measures tell only part of the story. There are a number of locations where converting a street to two-way traffic will be particularly problematic. Five locations were provided as examples, including the following:

- **Muhammad Ali:** 3rd Street to 5th Street
- **Liberty Street:** 2nd Street to 5th Street
- **Main Street:** 6th Street to 9th Street
- **Third Street:** Main Street to Liberty Street
- **Floyd Street:** Muhammad Ali to Main Street

Each of these locations is restricted by the available street width and/or the existence of on-street parking. The section of Muhammad Ali between 3rd and 5th streets is approximately 34 feet wide from curb to curb and has parking on both sides of the street. Even if this parking were eliminated, accommodating left turn lanes would be impractical due to the street width. Brian also noted that trucks, even single unit delivery trucks, would have difficulties negotiating a turn from southbound 3rd Street to westbound Muhammad Ali and remaining in the single westbound lane.

West of 2nd Street, Liberty Street has on-street parking and provides access to the Marriott parking garage and delivery entrance. Liberty carries a heavy volume of traffic during the P.M. peak hour as it provides access to northbound I-65 east of Floyd Street. This volume of traffic necessitates two eastbound through lanes, but that precludes the construction of a left turn lane from Liberty Street to northbound Second Street which is also a necessity. Even if the parking were removed west of 2nd Street, accommodating a left turn lane would be difficult due to the street width.

Main Street transitions from four lanes to three lanes at 6th Street. The current assumption is that under two-way traffic, two westbound lanes would be maintained and a single eastbound lane would be provided. This condition makes left turns difficult to accommodate and contributes to increased congestion.

Between Liberty Street and Main Street, 3rd Street is two lanes wide and there is on-street parking north of Market Street and south of Jefferson Street (there is no parking along 3rd Street under the Kentucky International Convention Center, but there are drop-off locations). Providing additional lanes would require eliminating the parking.

Floyd Street is somewhat of an issue today in the vicinity of Kosair Children's Hospital. The stop-controlled intersection at Abraham Flexner Way and segments to the north carry significant traffic volumes during the P.M. peak hour. Under a two-way scenario, accommodating left turns at Muhammad Ali, Brook Street, and Floyd Street contributes to significant delays at those intersections. Removing the on-street parking along sections of Floyd Street may help by providing opportunities for left turn lanes.

Other issues were discussed that must be considered before decisions regarding two-way traffic can be made. The reconstruction of the Kennedy Interchange may take up to 13 years to complete, and Brian noted that during several construction phases, interstate travel through downtown Louisville will be impeded by lane closures. The maintenance of traffic plans attempt to provide as many open interstate lanes as possible, but there will be prolonged periods where lane closures and

ramp closures will cause traffic to divert to city streets, particularly Main Street and Market Street. (It was also mentioned that Main Street and Market Street also serve as diversion routes in the event a crash closes I-64.) Once construction of the Kennedy Interchange is nearing completion, the 3rd Street exit ramp from I-64 will close, replaced with a new ramp from westbound I-64 and southbound I-71 to River Road. At that time, 3rd Street may make a more viable candidate for two-way traffic.

Brian also mentioned the potential for impacts to delivery vehicle traffic. Currently, many delivery vehicles will stop in a traffic lane for a brief period of time to unload parcels. This is not a significant issue on a one-way street as vehicles can use the adjacent lanes to pass. However, as most streets would not have more than one lane in each direction with two-way traffic, delivery vehicles would completely stop traffic flow in one direction if they were to stop in a travel lane.

There was much discussion regarding impacts to the operations of the existing downtown parking garages. It was noted that the study has not yet examined those impacts, but it is in the scope to do so for the final two-way scenario. Four additional parking garages are currently planned in the downtown area, and will have to be considered in that process. The proposed Center City development was also discussed. The current plan for this large mixed-use development, to be located on the block between Muhammad Ali and Liberty Street and 2nd and 3rd streets (known as the old Louisville Water Company site), calls for an access road off existing 3rd Street. Access to this street from a two-way 3rd Street would be difficult to accommodate, particularly left turns into or out of the development.

The issue of safely accommodating bicyclists and pedestrians was discussed at length. Pat Johnson noted that some striped bicycle lanes, such as those on East Main Street, would most likely have to be removed in order to accommodate two-way traffic. With respect to pedestrians, there was discussion concerning whether one-way traffic, with higher travel speeds but traffic approaching crosswalks from only one direction, is safer than two-way traffic.

A question regarding which streets are currently considered feasible for conversion to two-way was asked. There was some discussion on the issue, but Brian said that other than those streets already planned, west of I-65 only 6th Street stood out as a good candidate. There may be an opportunity for 5th Street, but impacts to the large number of TARC routes that travel that street and impacts to parking garage operations south of Liberty Street would have to be investigated. East of I-65, Preston Street would be difficult to convert as it serves University of Louisville Hospital and will carry additional traffic in the future when the proposed River Road exit ramp is open to traffic. With that ramp in place, River Road and Preston will provide a more direct connection for southbound vehicles traveling to one of the area hospitals. South of Broadway, there are no significant issues with converting the remaining one-way east-west streets to two-way, with the exception of St. Catherine near I-65. The I-65 interchange would be difficult to accommodate efficiently with St. Catherine being two-way.

In summary, the preliminary consensus of the group was that traffic was only one of a number of issues that must be considered in determining the feasibility of converting one-way streets to two-way traffic. Adequate traffic conditions can most likely be maintained on many of the streets under consideration, but the costs and impacts associated with modifying these streets to better accommodate two-way traffic flow may offset the likely benefits. It was decided that an additional meeting should be held to discuss the final scenario to be analyzed. This meeting will include additional Metro staff as well as representatives from PARC and TARC.

The meeting adjourned at approximately 11:30 a.m.

Meeting Summary

TO: Patti Clare
Downtown Development Corporation

FROM: Tom Creasey, P.E.
ENTRAN, PLC

DATE: January 9, 2009

SUBJECT: Downtown Louisville Two-Way Street Analysis
Project Status Meeting

A project status meeting for the Downtown Louisville Two-Way Street Analysis was held at the Downtown Development Corporation's office at 10 a.m. on Monday, January 5, 2009. The following individuals were in attendance:

Patti Clare	Downtown Development Corporation
Rebecca Matheny	Downtown Development Corporation
Pat Johnson	Louisville Metro – Public Works
Brian Aldridge	ENTRAN, PLC
Tom Creasey	ENTRAN, PLC
Ashley Williams	ENTRAN, PLC

Introduction

Brian Aldridge began the meeting with a summary of the project status and an explanation of the final scenario. He delivered a presentation to the group and key issues were discussed throughout the presentation. He began by summarizing the agenda items of the meeting, including: (1) to discuss the preliminary assumptions of the final two-way scenario; (2) to discuss the simulation results of the final scenario compared to the existing, base 2010, and ultimate 2010 scenario; (3) to explain the local impacts of closing Second Street between Main Street and Washington Street; and (4) to discuss any outstanding issues before a final report is prepared.

A fourth scenario, referred to as the "Final Scenario", was analyzed to include the existing-plus-committed ("E+C") network and additional one-way street segments converted to two-way traffic. The E+C network included the conversion of 7th and 8th Street, Jefferson Street east of the proposed I-65 ramp mid-block between Brook and Floyd Street, and Shelby and Campbell Street to two-way traffic flow. The Final Scenario adds to that the conversion of the following street segments:

- Main Street between Second Street and Baxter Avenue
- Liberty Street between Jackson Street and Baxter Avenue
- Muhammad Ali Boulevard between Jackson Street and Chestnut Connector

- Chestnut Street between Jackson Street and Chestnut Connector
- Third Street between Main Street and Market Street
- Second Street between River Road and Washington Street

Also, the Final Scenario includes the closures of Second Street between Main and Washington Street and Washington Street between Second and Third Street (this segment has already been removed for construction of the Louisville Arena).

Final Scenario Assumptions

Brian proceeded with the presentation by detailing the assumptions that were made for the final scenario. Assumptions at the Second and Main Street intersection were first discussed. He explained that dual left turns would be warranted for the northbound approach. Pat Johnson agreed that they would be needed with the high turning movement projected. Tom Creasey mentioned that a few traffic signals in Lexington operate with dual left turn lanes during the peak period and as single turn lanes during off-peak periods.

Brian also stated that the northbound through movements would be slightly misaligned if the current cross section and striping were maintained. Pat Johnson discussed ways to better align the intersection. The group then discussed the existing dual right turn lanes for the southbound approach. It was pointed out that the current configuration was a safety issue for pedestrians crossing Second Street. Brian pointed out that a single right turn lane would result in longer queues on the bridge, particularly during the morning peak hours. Pat explained that the refuge island could be expanded to account for the single right turn lane. Patti Clare requested that ENTRAN quantify the difference in the delay between the existing dual right-turn lanes and a proposed single right-turn lane. Brian agreed to deliver those results.

Baxter Avenue at Main Street was the next intersection discussed. It was assumed that if the west leg of the intersection was converted to two-way traffic, a traffic signal would be required to accommodate all proposed turning movements. A roundabout was also discussed as a potential alternative to consider for the intersection. Concerns were raised about funding the reconstruction of the intersection. Pat stated that a shorter segment of Main Street could be converted to two-way traffic within the Central Business District (CBD). The issue was left on the table; therefore the final scenario would still include the Baxter at Main Street reconfiguration with a traffic signal.

Brian detailed the Liberty Street at Baxter Avenue intersection assumptions. The southbound right turn would be difficult for vehicles due to the skew angle of the intersection. The group agreed that the turning movement volume would be very minimal and not allowing the southbound right turn at the intersection would suffice.

Final Scenario Results

After the assumptions were discussed, network-wide performance measures for the final scenario were presented. Brian explained that the “Completed Trips” reported the number of vehicles that completed their trip during the simulation run. Fewer trips were completed in the 2010 scenarios as compared to the existing scenario because there was more traffic in the future year simulation scenarios, thus more congested routes. Patti requested to see the percent completed trips of the total trips in the network.

Vehicle-miles traveled (“VMT”) were compared for the four scenarios. This performance measure slightly increased for the final 2010 scenario as compared to the ultimate 2010 scenario. The probable explanation is the increase in the percentage of trips completed in the network for the final 2010 scenario. Since more vehicles are completing their trips, more vehicle-miles are

traveled. The vehicle-hours traveled ("VHT") demonstrated similar results. The final 2010 scenario had more vehicles completing their trips in the network than the ultimate 2010 scenario, which implies that less congestion was present. Therefore, less time was spent for the vehicles to complete their trips.

Total delay is another network-wide performance measure that can be compared for multiple simulation scenarios. It was noted that a significant difference exists between the existing scenario and the base 2010 scenario. ENTRAN explained that the additional traffic generated by the Museum Plaza is one reason for the increase in demand and congestion along River Road, thus causing the delay to increase. Given the current construction status of Museum Plaza, the group discussed the possibility of "scaling back" the traffic generated by the development to obtain more realistic simulation results for the 2010 scenarios. ENTRAN agreed to develop an additional scenario, "Final 2010 Modified", by reducing the traffic generated by Museum Plaza to 50 percent of the initial projection. Results from the new scenario will be presented to the group when completed.

Brian then presented the average travel speeds recorded for the duration of the peak hour simulation runs. Overall, travel speeds decreased slightly for the 2010 scenarios. The final 2010 scenario had higher average speeds than the ultimate 2010 scenario. This suggests that the final 2010 scenario has less congestion, as vehicles traveled at speeds closer to the posted speed limits.

Delays for several key intersections were analyzed. Those intersections included:

- Main Street at Preston Street
- Main Street at Second Street
- Main Street at Third Street
- River Road at Second Street
- River Road at Third Street

Delay comparisons between the existing scenario and the final 2010 scenario were presented. No increases in delay were of significance, with the exception of River Road at Second and Third Streets in the P.M. simulation model. The probable cause of this delay is the additional traffic generated from both the Museum Plaza and the closure of Second Street. Patti Clare requested that the consultants provide the intersection delays for the other two scenarios as well for comparison.

Segment travel times along the roadways that were converted to two-way traffic in the final 2010 scenario were also presented to the group. The models suggest no significant increases in travel times as compared to the existing scenario.

Second Street Analysis

The consultant performed in-depth analysis of the Second Street closure. Brian stated that the majority of the current traffic utilizing North Second Street is destined for the Second Street ramp to access I-64/I-71. Parking garage access is also located on the segment north of Witherspoon Street.

Because the simulation network does not include the surrounding interchanges, the KIPDA regional travel demand model was utilized to compare traffic volumes with and without the Second Street segment. One concern was whether traffic would use other nearby interchanges, such as the Ninth Street, Zorn Avenue or Mellwood Avenue instead to access I-64/ I-71. The model output shows that the majority of traffic still uses the Second Street ramp. With the closure

of Second Street, River Road traffic between Second and Third Streets increases by approximately 50 percent. Additionally, Main Street and Third Street traffic increases.

The model output demonstrates that the roadways relatively close to the Second Street ramp are most affected and therefore congestion is expected to increase during the hours when the ramp is most heavily utilized. The KIPDA model also shows that North Second Street segment between Witherspoon Street and River Road is still used to access the Witherspoon parking garage. Because that segment is open to two-way traffic in the final scenario, the model analyzes the segment as the shortest path into the garage.

During the discussion of the increased traffic on Third Street due to the Second Street closure, Patti Clare stated that a new parking garage was planned for the Galt House Hotel to serve its east towers. The garage would be located just north of the towers along Third Street between Main Street and River Road. Patti added that the capacity of the garage was 800 spaces. She was not aware of the proposed access plan for the garage, but said that she would request that information. The group discussed the possibility of access onto Third Street. Brian stated that a signal may be warranted for the entry/exit point during peak hours. It was noted that a traffic signal at that location, if necessary, would provide a safety benefit for the pedestrians crossing Third Street for arena events.

Final Scenario Issues

Brian continued by discussing particular intersections that would be problematic under the final 2010 scenario. He stated that the Main at Second Street traffic signal would need to remain as part of the downtown grid. The cycle length would need to be consistent with the surrounding signals. Pat added that the downtown cycle lengths are currently at the maximum length to safely accommodate the heavy pedestrian movements. Brian stated that the southbound left turns onto eastbound Main Street would not be allowed. Pat Johnson agreed, adding that southbound vehicles can turn left at Market Street.

Next, the intersection of River Road and Second Street was discussed. Brian stated that it may be beneficial to prohibit northbound left turns since the demand for this movement is very low. This would allow the westbound traffic to flow continually. Tom added that this type of intersection is common in states such as Texas and Florida. Another issue with this intersection is whether to allow westbound traffic to turn left onto Second Street. Patti explained that the arena would be selecting a consultant to develop traffic plans for the surrounding network. Details would not be known until that study is complete.

Parking Garage Impacts

As part of this study, ENTRAN was asked to investigate the impacts to parking garage access due to the two-way street conversion. Two parking garages were identified as being impacted by the final 2010 scenario. The first garage is the 420-space Actors Theater Garage on Third Street north of Market Street. It was decided that Third Street access to the garage, assuming this segment of Third Street is converted to two-way traffic flow, would be provided as right-in/right-out only. The second garage discussed was the 647-space First and Main garage. Currently, access is provided on both First Street and Main Street. With the conversion of Main Street to two-way traffic, it is recommended that the Main Street access be provided as right-in, right-out only. Existing access would remain as-is on First Street.

Other Impacts

The westbound bike lane on Main Street would remain in place if converted to two-way traffic flow. However, no additional right-of-way would exist to stripe a bike lane for the eastbound direction. The group agreed that Market Street would serve as the eastbound bike route.

Conclusion

In summary, the preliminary results of the final 2010 scenario suggest that it would be feasible, given that minor adjustments to intersections would have to be implemented in order to accommodate two-way traffic. Highest concerns amongst the group focused on the added congestion surrounding the Third Street/River Road vicinity. It was decided that an additional meeting should be held to discuss the results of the "Modified Scenario" to decrease the traffic generated by Museum Plaza and discuss further the possibility of accommodating new parking garage access onto Third Street north of Main Street.

The meeting adjourned at approximately 12:30 p.m.